LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – CHEMISTRY

FIFTH SEMESTER – NOVEMBER 2019

CH 5513 – FUNDAMENTALS OF SPECTROSCOPY

Date: 02-11-2019   Dept. No.   Max. : 100 Marks
Time: 09:00-12:00

Part-A

Answer ALL questions.   (10 × 2= 20)

1. What is electromagnetic spectrum?
2. Define the term signal to noise ratio.
3. State Beer Lambert's law.
4. What are auxochromes? Give an example.
5. State Mutual exclusion principle.
6. What is the significance of monochromator in a spectrophotometer?
7. What are magnetically equivalent protons? Give an example.
8. Mention the significance of TMS in NMR technique.
9. State Nitrogen rule.
10. What is the base peak of toluene in mass spectroscopy?

Part-B

Answer any EIGHT questions.   (8 × 5= 40)

11. Write a note on (i) FT and (ii) CAT
12. What are absorption and emission spectra? Explain.
13. Explain the types of electronic transitions with examples.
14. Discuss the principle and any one application of AAS.
15. Write short notes on Stokes and antistokes lines.
16. An organic compound with the molecular weight 120 shows an intense peak at m/e =105 in its mass spectrum. Other prominent peaks are found at m/e 77, 51, 43 and 39. It also shows a strong absorption at 1700 cm^{-1} in its IR spectrum. It forms oxime derivative with hydroxylamine, but shows negative Tollen's and Fehling's tests. Suggest the structure of the compound.
17. What is chemical shift? Discuss any two factors affecting the chemical shift.
18. Explain shielding and deshielding effects with examples.
19. Differentiate between base peak, molecular ion peak and isotope peak with suitable examples.
20. Discuss the various bending vibrations in IR spectroscopy.

21. Explain the mass spectral fragmentation pattern of phenyl acetaldehyde.

22. Discuss the following IR absorption peaks of phenol.

    (i) 3330 cm^{-1}, (ii) 3040 cm^{-1}, (iii) 2000 – 1600 cm^{-1}, (iv) 1580, 1495, 1470 cm^{-1},

    (v) 1360 cm^{-1}.

art-C

Answer any FOUR questions. $(4 \times 10 = 40)$

23. Explain the factors affecting the line width and intensity of spectral lines.

24. Discuss the principle and instrumentation of flame photometer with a block diagram.

25. Discuss in brief the instrumentation of double beam spectrophotometer.

26a. Explain the use of IR spectroscopy to differentiate inter and intramolecular hydrogen bonding with examples.

  b. Differentiate between fundamental vibrations and overtones. (5+5)

27. How is primary, secondary and tertiary alcohols differentiated using mass and IR spectroscopy? Explain.

28. An organic compound with the molecular mass 72 absorbs at 274 nm (ε_{max} =17). In IR

    spectrum, a strong absorption band is observed at 1715 cm^{-1} and medium absorption

    bands are observed at 2941-2857 cm^{-1} and at 1460 cm^{-1}. It answers iodoform test and

    shows mass spectra at m/e values of 72, 43, and 29. The signals in NMR are 7.52τ quartet,

    7.88τ singlet and 8.93τ triplet. Deduce the structure of the compound and explain.

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